RDIO 16/16-0,5

Remote I/O Module

V.1.2

User Handbook

A u t o m a t i o n S y s t e m

CANtrol®

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General Information on this Manual

Content:
This manual describes the RDIO 16/16-0,5 CANtrol module and its modifications. The product-related information contained herein was up to date at the time of publication of this manual.

Completeness:
This manual is complete only in conjunction with the user manual entitled

'Introduction
to CANtrol Automation System'

and the product-related hardware or software user manuals required for the particular application.

Standards:
The CANtrol automation system, its components and its use are based on International Standard IEC 61131 Parts 1 to 4 (EN 61131 Parts 1 to 3 and Supplementary Sheet 1).
Supplementary Sheet 1 of EN 61131 (IEC 61131-4) entitled 'User Guidelines' is of particular importance for the user.

Order numbers:
Please see the relevant product overview in the 'Introduction to CANtrol Automation System' manual for a list of available products and their order numbers.

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Update

Version	Date	Subject
1.0	09.99	First version
	02.08.00	IEC 1131 changed by IEC 61131, Export hint removed, Block diagram corrected, Text completed in Schematic Diagram of Input/Output Grouping, Data type PdoCommPar corrected, Modul type formal amended.
1.1	02.09.02	Formal updates, company name and product names hint removed, modification graphic 'Module diagram'.
1.2	23.05.03	Update in 'Remote Modules with 32 digital I/O' and ' Object Dictionaries'

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1. General Instructions

1.1. Hazard Categories and Indications

The indications described below are used in connection with safety instructions you will need to observe for your own personal safety and the avoidance of damage to property.

These instructions are emphasised by bordering and/or shading and a bold-printed indication, their meaning being as follows:

DANGER !	means that death, severe physical injury or substantial damage to property will occur on failure to take the appropriate precautions.

Warning !	means that death, severe physical injury or substantial damage to property may occur on failure to take the appropriate precautions.

Caution	means that minor physical injury or damage to property may occur on failure to take the appropriate precautions.

Note:
provides important information on the product or refers to a section of the documentation which is to be particularly noted.

1.2. Qualified users

Qualified users within the meaning of the safety instructions in this documentation are trained specialists who are authorised to commission, earth and mark equipment, systems and circuits in accordance with safety engineering standards and who as project planners and designers are familiar with the safety concepts of automation engineering.

1.3. Use as Prescribed

This is a modular automation system based on the CANbus, intended for industrial control applications within the medium to high performance range.

The automation system is designed for use within Overvoltage Category I (IEC 364-4-443) for the controlling and regulating of machinery and industrial processes in low-voltage installations in which the rated supply voltage does not exceed 1,000 VAC (50/60 Hz) or 1,500 VDC.

Qualified project planning and design, proper transport, storage, installation, use and careful maintenance are essential to the flawless and safe operation of the automation system.

The automation system may only be used within the scope of the data and applications specified in the present documentation and associated user manuals.

The automation system is to be used only as follows:

- as prescribed,
- in technically flawless condition,
- without arbitrary or unauthorised changes and
- exclusively by qualified users

The regulations of the German professional and trade associations, the German technical supervisory board (TÜV), the VDE (Association of German electricians) or other corresponding national bodies are to be observed.

Safety-oriented (fail-safe) systems

Particular measures are required in connection with the use of SPC in safety-oriented systems. If an SPC is to be used in a safety-oriented system, the user ought to seek the full advice of the SPC manufacturer in addition to observing any standards or guidelines on safety installations which may be available.

Warning ! As with any electronic control system, the failure of particular components may result in uncontrolled and/or unpredictable operation. All types of failure and the associated fuse systems are to be taken into account at system level.
The advice of the SPC manufacturer should be sought if necessary

2. Remote module with 32 digital I/O

2.1. Overview

Order number

The order/item No. required for acquiring a replacement is to be found on the nameplate of the module.

Function

The module is a CANopen-capable remote module with 32 digital I/Os and fixed functionality. The module is a CANopen slave device complying with CiA Draft Standard DS401. The remote module comprises 16 digital inputs and 16 digital outputs. Each output is also usable as an input (combined I/Os). The Remote module can be extended locally by connecting digital expansion modules.

E bus expansion

The I/O level of the Cell Controller can be extended by adding a maximum of 6 E-bus expansion modules, each with 32 digital I/Os.
Assembling e.g. 6 digital expansion modules is equivalent to 224 I/Os.

Features

- MC 68332 CPU / 25 MHz
- 2 MB flash memory 1.25 MB CMOS RAM
- 16 digital inputs and
  16 digital, individually configurable inputs/outputs;
  outputs may be supplied with power in groups.
- I/O layer locally extendible over internal E-bus with
  up to six expansion modules (digital)
- Minimal space requirement and mounting depth
- Maintenance-free, having no buffer battery

Material supplied

The material supplied comprises:

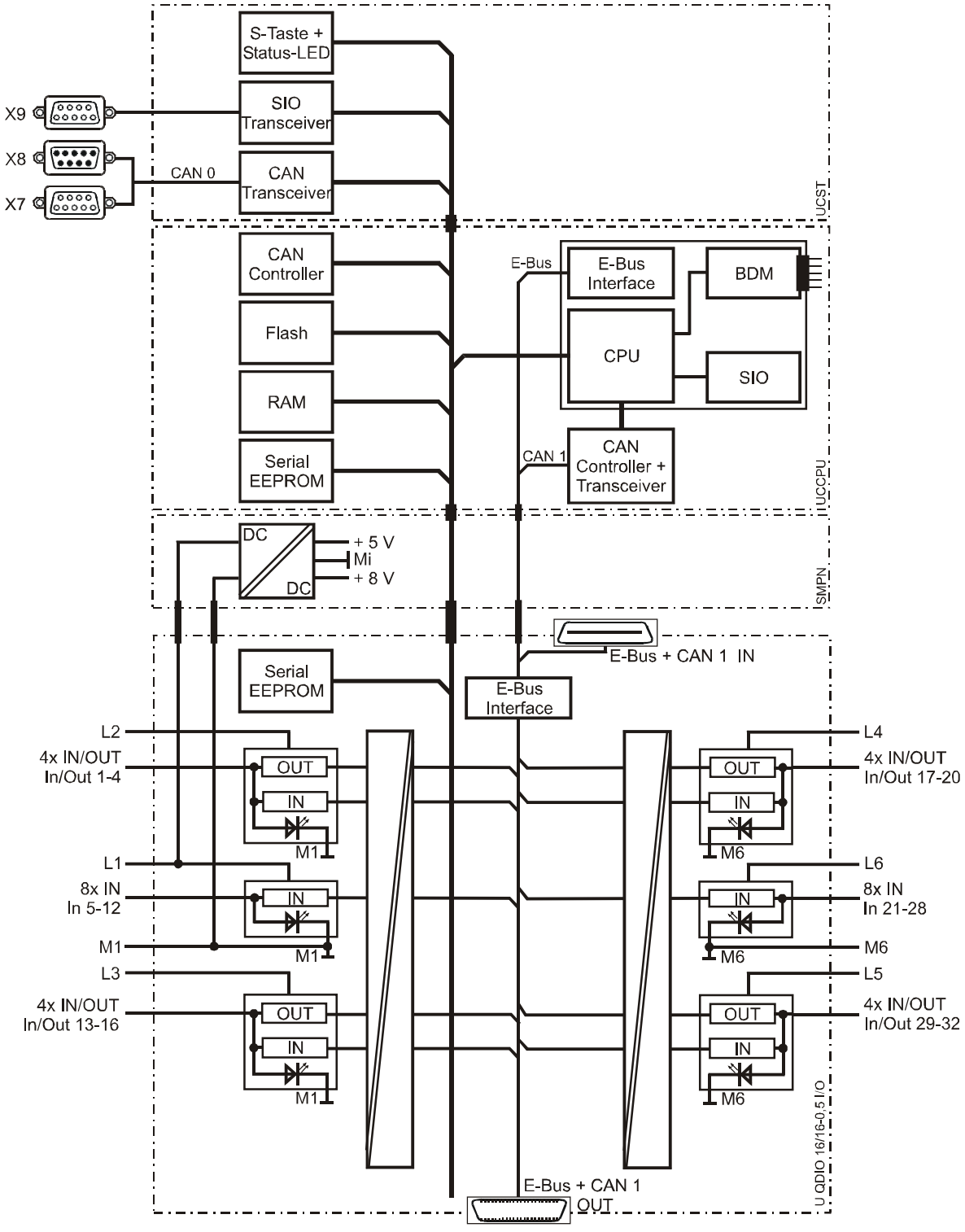
- Remote module with 32 digital I/Os

Note:
See section on 16/16-0,5 digital I/Os for information on digital I/Os and the formation of I/O groups.

2.2. Technical Data

Module data	
Dimensions W × H × D [mm]	124 x 170 x 85,5 (modular dimension W = 113/118,5)
Weight	approx. 700 g
Mounting	NS 35/7.5 EN 50022 mounting rail
Expansion	with up to 6 E-bus expansion modules
Working temperature range	5°C to 50°C (no moisture condensation) convection cooling provided
CPU	MC 68332 / 25 MHz
Flash EPROM / SRAM	2 MB / 1.25 MB
Parameterisation	CANopen
EMC, class of protection, insulation testing, degree of protection	
Emitted interference	EN 50081-2, industrial sector
Noise immunity	EN 50082-2, industrial sector
Class of protection	III
Insulation resistance	EN 61131-2; 500 VDC test voltage
Degree of protection	IP 20
Supply voltage, power consumption	
Module electronics power supply (supply voltage)	SELV +24 VDC max. 0.15 A (EN 61131-2)
Power supply, digital I/Os	+24 VDC (EN 61131-2) subdivided into 6 groups
Power consumption	at U_e= +24 VDC no load max. 300 mA, fuse protection according to load on I/Os, max. 10 A
Power-supply reverse voltage protection	yes
Electrical isolation	yes, between CANbus and digital I/Os
Digital inputs/outputs (DIO)	
Number of inputs	16
Number of inputs/outputs	16, individually configurable as inputs or outputs
Output current	0,5 A
Switching level of inputs/outputs	positive-switching
Short-circuit protection	yes
Connection method	vertical three-wire front wiring with push-on terminal strips for screw, spring or crimp connection
Serial data interfaces	
Number and type of interface	1 RS232 (X9) for configuration
CAN interfaces	
Number and type of interface	1 standard CAN ISO11898 (channel 0 on X7/X8)
Operation and display	
LEDs	5 status LEDs; 1 status LED per input/output
‘S’ button	yes, at the front (including module reset)
Configuration	via CANbus or RS232 interface

2.3. Block Circuit Diagram



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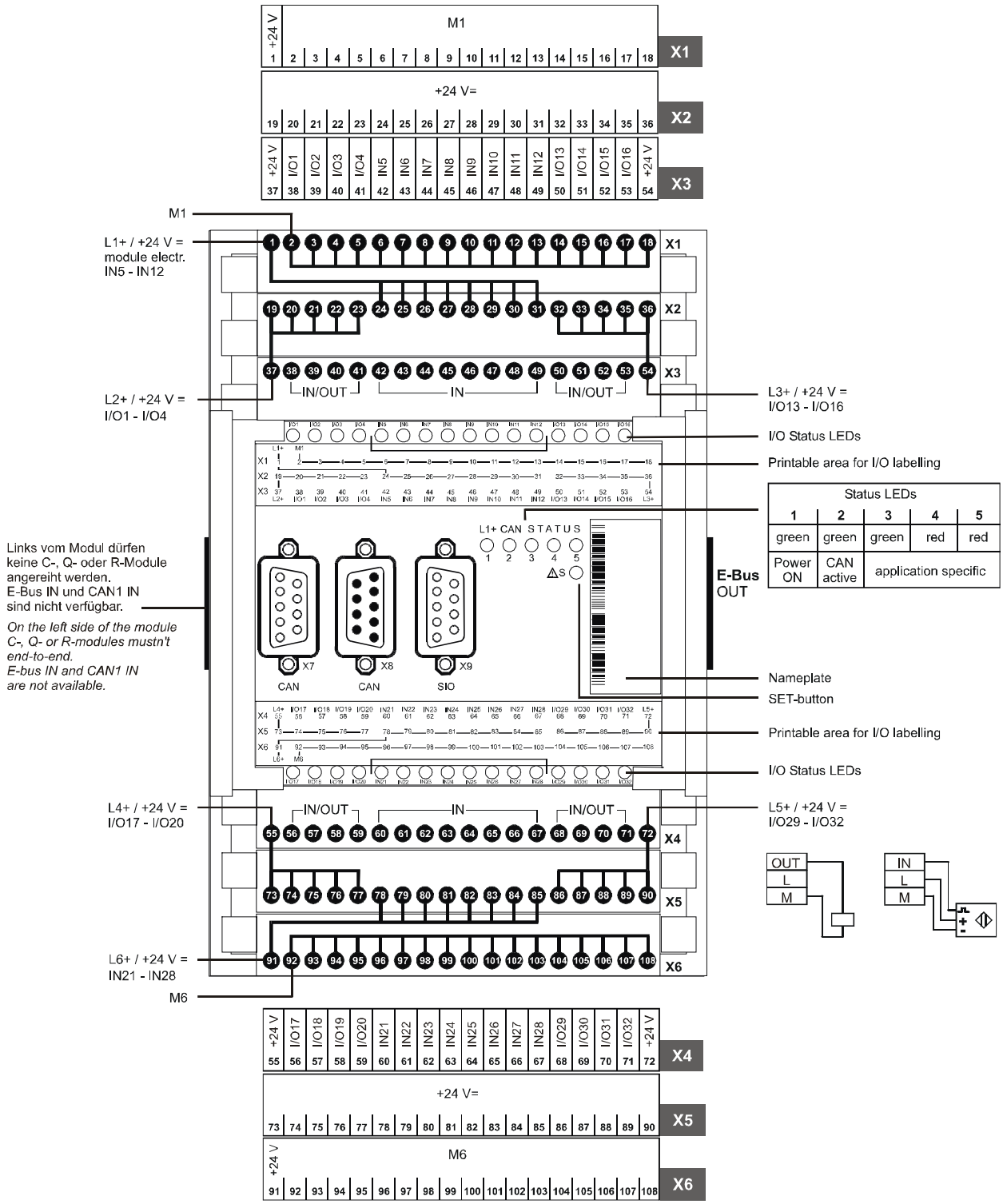
2.4. Module Diagram and Connection Assignment



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2.5. Assembly Operation

Warning ! Do not insert, apply, detach or touch connections when in operation! Destruction or malfunctioning may otherwise occur. Disconnect all incoming supplies before working on modules; including those of connected peripherals such as externally supplied sensors, programming devices, etc.

2.5.1. Commissioning

Re-examine all connections for correct wiring and polarity before applying the supply voltage. Then switch on supply voltage.

Boot UP

After the supply voltage is switched on, the remote module carries out a boot-up process in accordance with the CiA DS301 minimum capability device. A boot-up identifier is transmitted in the form of an emergency telegram without data bytes. The telegram CAN identifier (CobId) is derived from 128 + node number (NodeId). Then the remote module switches to pre-operational state and can be operated via CANopen SDO accesses. The number of coupled expansion modules is automatically recognised during the boot-up process and entered in the corresponding objects in the object dictionaries.
The I/O status LEDs of the digital outputs will not light up during boot-up. The outputs are set to 0 (low) when switching on and off the module electronics and remain in that state until the next switching command. No occurrence of brief switching peaks.

I/O access

The I/Os are accessed via the CANopen communication profile defined in CiA Draft Standard DS301.
All I/O channels can optionally be operated via SDO or PDO telegrams. Additionally, all inputs can create edge-triggered event telegrams.

PDO/SDO telegrams In order to operate the remote module using PDOs (process data objects), the module has to be switched over to the operational state with the corresponding NMT command (start node).
The remote module supports 2 PDO telegrams each in the transmit and receive directions. After switching on in this way, the first transmit and receive PDO pair is activated. The second transmit and receive PDO pair is de-activated and can be activated with respect to operating time via corresponding SDO (service data object) accesses.
All PDOs are implemented solely as asynchronous event PDOs (no synchronous operation).

Node Guarding

A CANopen master available in the CAN network can operate the remote module via node guarding telegrams. The module responds in accordance with the node guarding protocol specifications by transmitting the corresponding operational status with toggle bit. The life guarding function (Monitoring of the CANopen master from the slave) is implemented.

See associated software documentation for further information.

2.5.2. Function Selection, Displays, Diagnostics

Warning ! Do not touch ‘S’ button during normal operation.
Program sequence could otherwise be put into an undefined state.
Risk of uncontrolled system and machine states!
Put system/machine into a safe initial state (‘maintenance’ mode for example) before actuating the ‘S’ button.

‘S’ button Used to switch between modes and to re-start the module. The function of the ‘S’ button is software-dependent.

I/O status Each input and output has a yellow I/O status LED assigned to it to indicate the logic state of the input or output in question.

Operating status 5 operating status LEDs indicate the current state of the power supply, module mode and other functions.
Error messages are also displayed by these status LEDs.

I/O status

LED status	Logic state
input LED yellow ON	1 (HIGH, activated)
input LED yellow OFF	0 (LOW)
output LED yellow ON	1 (HIGH, activated)
output LED yellow OFF	0 (LOW)

Operating status

LED	Logical status
1 L1+ (green)	ON = correct supply voltage for module electronics
2 CAN status 2 (green)	ON = CAN 0 send, active
3 CAN status 3 (green)	module active (see software manual)
4 CAN status 4 (red)	alternating flashing indicates configuration mode on (see software manual)
5 CAN status 5 (red)	alternating flashing indicates configuration mode on (see software manual)

3. Configuration and Programming Tool

3.1. Programming Tool

The most commonly-used **p**rogramming **a**nd **d**iagnostic **t**ool (**PADT**) is a personal computer provided by the user.

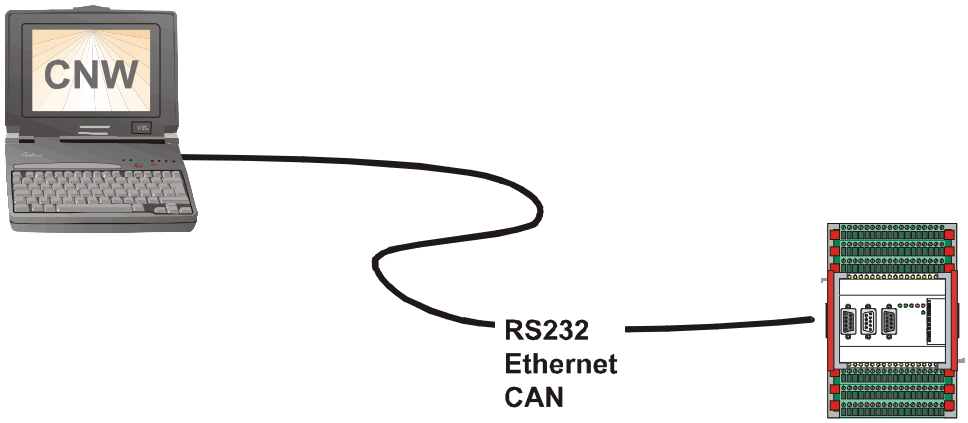
The features of this peripheral strongly determine how safe and reliable the operation of the automation system with a connected PADT will be.
Commercially available PCs are in general not suitable for use under the operating conditions defined for automation system (industrial environment).

Caution The user should specially ensure that the conditions necessary for safe operation as a PADT are fulfilled by the user's chosen PC.

The PADT can be connected to the automation system via

- the CANbus
- the serial module interface
- the Ethernet interface (CEDIO…)

Konfiguration von Node ID und Baudrate mit Peer-to-Peer Verbindung
Configuration of the node-ID and baudrate with peer-to-peer connection



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3.2. Configuration of Cell Controller with the CNW Tool

New or replaced cell controllers have to be configured before they are used in an application. This procedure can be compared with setting selector switches in other systems. Such switches were deliberately omitted when the automation system was being designed, since these do not allow the array of configuration data currently needed to be represented conveniently and neatly.
In place of this, the automation system uses the user-friendly CNW tool (**C**ANtrol **N**ode **W**izard), which guides you through the configuration process. The familiarisation and documentation requirements usually involved with setting configurations are thus reduced to a minimum.

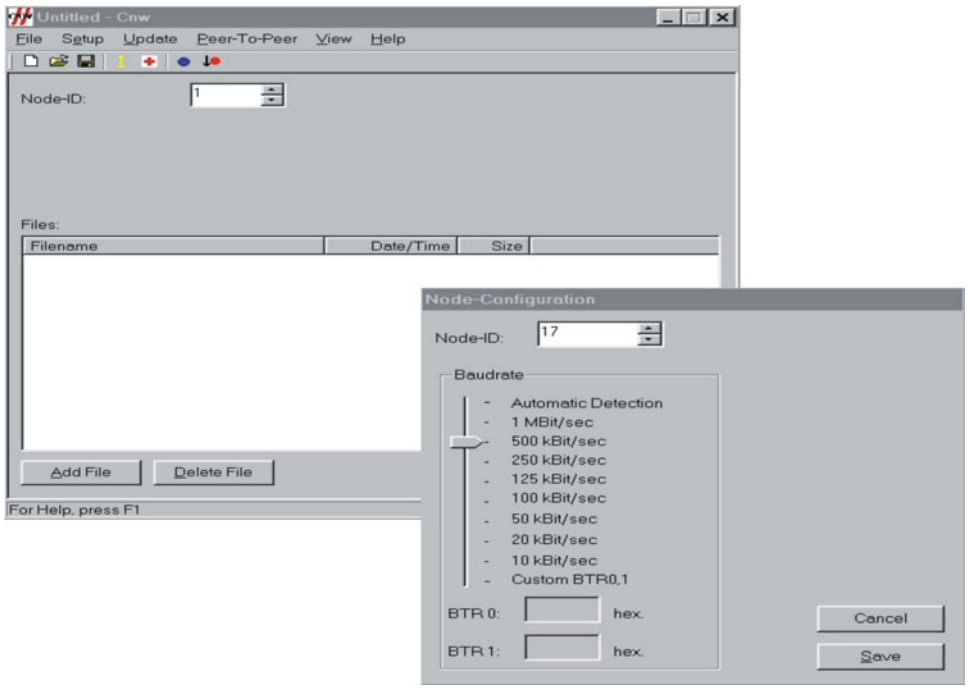
A single module is connected to the PADT (PC) for configuration.

The module has to be put into configuration mode after the supply voltage has been applied, or, depending on previous use, it may already be ready for configuration.

Configuration mode is indicated by the alternate flashing of the status indicators (LED 4 and 5). If another status is signalled, press the ‘S’ button.

The elementary parameters ‘node ID’ (identification number) and ‘CAN baud rate’ are then configured using the menu item ‘peer-to-peer’. The data are validated in the module by pressing the ‘S’ button located on the module and operation is then possible on a correspondingly set-up CAN bus.

Example:



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Other functions of the CNW tool:

- Query firmware information:
  Enter the node ID of the required cell controller and the CAN baud rate in the main window.
  Then select *Firmware Information* in the 'Update' menu.

  This allows the firmware information for all cell controllers connected to CAN channel 0 to be queried. This function also allows communication via the CAN bus to be tested at the same time.
- Update firmware.
- Switch between application and configuration (also bootloader) mode: Select *Operation Mode* in the 'Update' menu; this is the same function as manual switching with the 'S' button on the module.

Configuration (bootloader) mode is only required for configuration and reloading of the firmware.

Note:
Further programming procedure is determined by the programming environment used (IEC 61131/C). For more information, see the relevant programming manuals.

3.3. Setting the Node ID

The individual CAN bus users are identified within the automation system communications by an unambiguous node ID.
The node ID numbers from 1 to 127 are permitted.
These numbers can be allocated at will, however, they do affect individual CAN user priorities *(do not confuse with CAN message identifiers)*.

Note:
Users of **the same** physical CAN line **must always** be allocated an unambiguous node ID.

3.4. CAN Baud Rate

In order to ensure successful CAN communication, there should be a uniform baud rate setting for all bus users. The values chosen should be selected in accordance with the maximum line length, but should not be unnecessarily high (extra safety factor).

Note:
Cell controller communication occurs during programming and maintenance in CAN exclusively by means of CAN channel 0 on the front panel of the module.
Channels 1 and 2 are reserved for the application programs.
There is always a uniform baud rate for a physical CAN line.
For this reason, baud rate settings **have to be** identical for all users located in the same line, both during configuration (with the CNW) and in the application programs. Different lines may have different baud rates.

3.5. Gateways – Exceptional Cases

A gateway provides the means for a cell controller to receive certain CAN messages over a given channel and to transmit these unchanged, i.e. with the same CAN identifier, over another channel, perhaps with a different baud rate.

In order to keep the system load to a minimum, it is possible and indeed advisable to let only a certain number of CAN messages pass through the gateway. The cell controller gateway functionality must explicitly be activated by the application program (function block or library function).

Note:
If you want to programme and maintain cell controllers behind a gateway, then the entire CAN identifier range (1409 to 1663) has to be transmitted in both directions. When this is happening, the node IDs of these cell controllers should not collide with other node IDs in the higher-level system.

In this case, the system cannot be programmed via the gateway node serial interface.

The application program must already be started on this node for the gateway to be activated; only in this way can the function blocks be called.

Individual configuration means that the user has a considerable degree of flexibility when it comes to arranging the gateway functionality.
It might be necessary for the user to have more in-depth knowledge of the communication protocols (CAN, CANopen) in order to implement the required functionality successfully. (Keywords: high system load or number of users, time-critical applications, etc.)

4. Digital Inputs/Outputs (high side-/low side switching)

Outputs may also be connected to inputs without additional external load.

4.1. Grouping of Inputs/Outputs

The grouping facility permits formation of groups, separate power circuits, emergency off circuits, etc. as and when required.
Inputs/outputs can be supplied in groups as
• 2 input groups and
• 4 output / input groups

The **modular electronic circuit** for C modules is supplied together with input group 2 (Group 2) over connection terminals 1 (L1+) and 2 (M1).
The modular electronic circuit must be supplied with power in **any** cases, otherwise the modules will be inoperable.
Supply must be provided directly (unswitched) from the supply unit.

Inputs

Inputs (sensors) must be supplied directly from the supply unit.
Do not conduct the sensor supply through switched circuits.

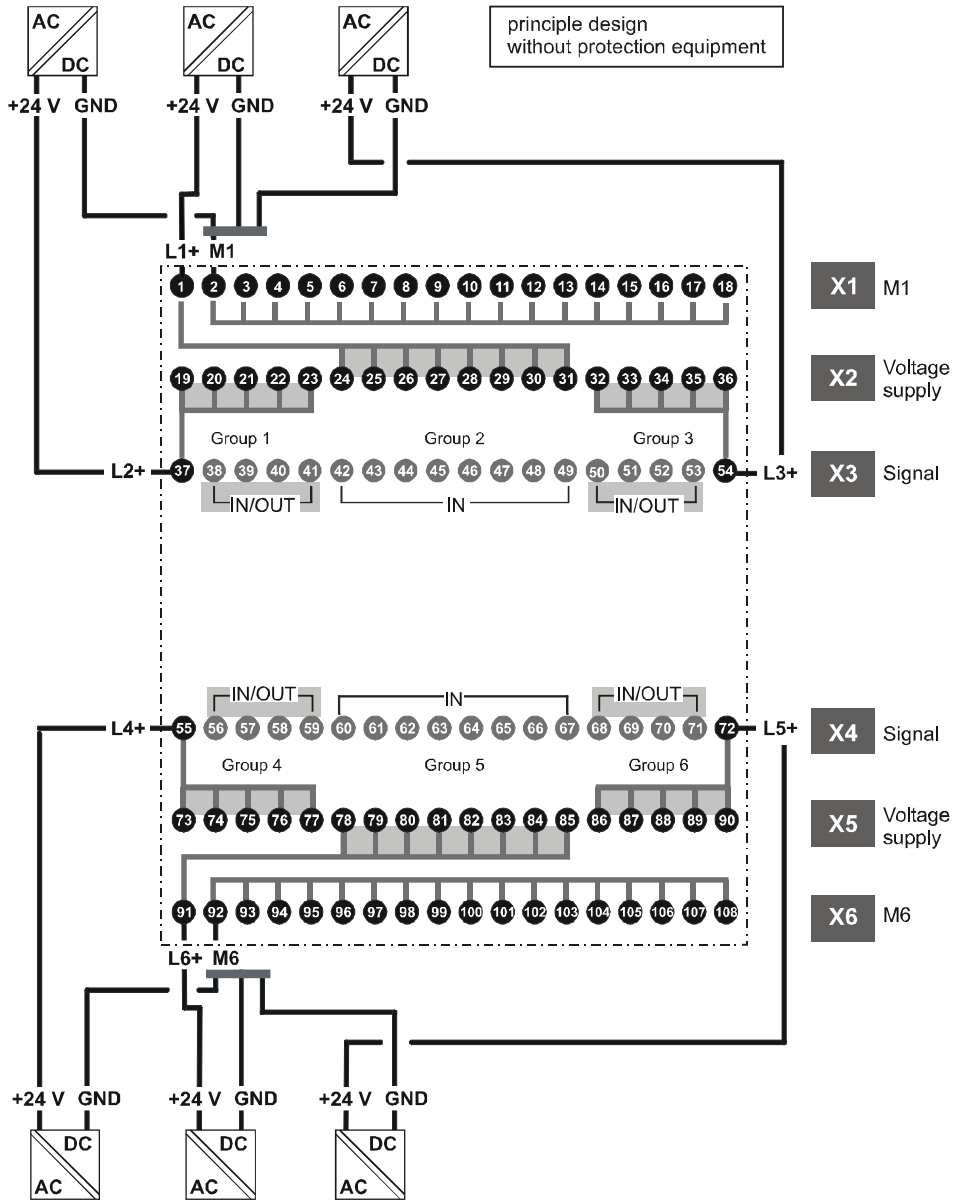
Outputs

Output groups may be supplied through upstream switch elements (emergency off, manual switches, etc.).

Warning !

Feedback could destroy the module and/or the sensors!
Otherwise, when group power supply is disconnected, connected sensors could produce a feedback over the output transistors.
Always make sure the sensors are each supplied from the same power source as the module's associated I/O group.

4.1.1. Schematic Diagram of Input/Output Grouping (high side-/low side switching)



Group 1	IN / OUT 1-4	*Bemessungsspannung für erhöhte Isolation nach Rated voltage for increased isolation defined by* *EN 61131-2* *0...50 V*
Group 2	IN 5-12	
Group 3	IN / OUT 13-16	
Group 4	IN / OUT 17-20	
Group 5	IN 21-28	
Group 6	IN / OUT 29-32	

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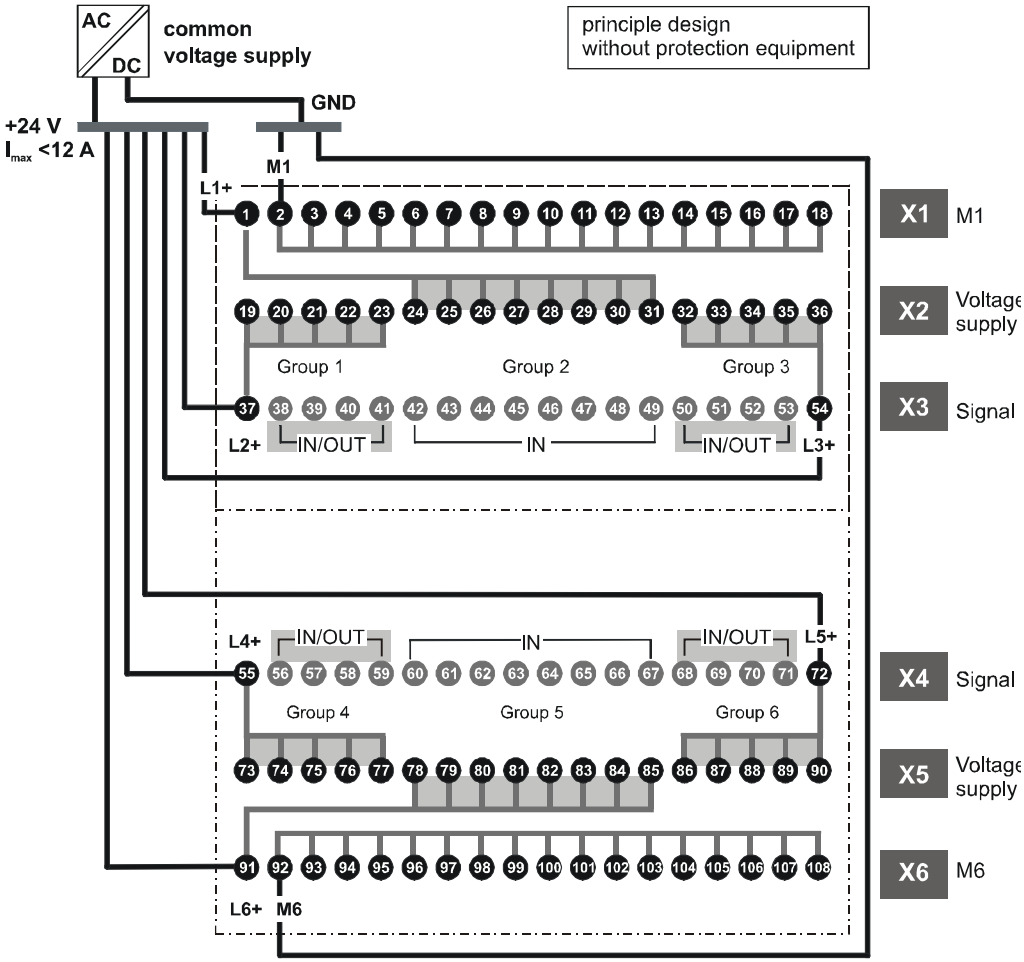
4.1.2. Without Grouping (high side-/low side switching)

Wird auf die Gruppenbildung bei der Spannungsversorgung verzichtet, sind vom Anwender die im folgenden Bild dargestellten Verbindungen herzustellen.

Without grouping of the voltage supply, the user has to build the following connection.



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4.2. Digital Inputs, high side switching

The digital inputs are high side switching type 1 inputs for 3-conductor sensors. They are designed for input voltages of 24 V nominal. The inputs are transmitted cyclically to the CPU. An open input is interpreted as static 0 (LOW).

Pulse recognition and interference suppression

Inputs are read cyclically. Pulses < 100 µs are hardware suppressed. The sampling interval can be parameterised by software. The shortest possible sampling interval is 250 µs.

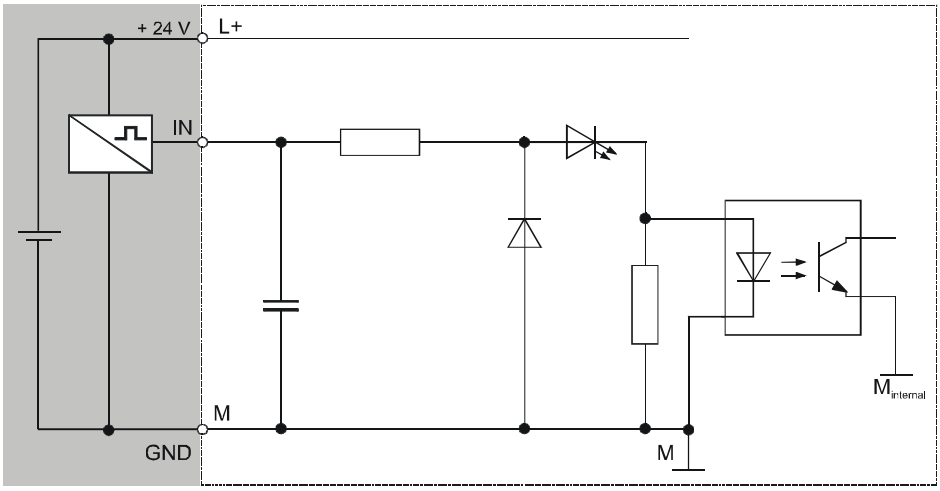
If pulses are to be detected reliably they must be longer than the sampling interval stipulated by software.
Multiple sampling can be programmed in order to suppress spurious pulses.
Sampling interval and multiple sampling (filtering) can be activated in groups of 32 inputs each.

Note:
This function is available only for C applications at present. Using IEC 61131-3 the filter is permanently set to 250 µs.

Operating status

The status of each input is indicated by a yellow operating status LED on the front panel of the module. The LEDs are spatially assigned to the supply terminals.
An LED lights when its associated input is activated (logical 1 / HIGH).

4.2.1. Block diagram of input, high side switching



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4.3. Digital Inputs, low side switching

The digital inputs are low side switching type 1 inputs for 3-conductor sensors. They are designed for input voltages of 24 V nominal. The inputs are transmitted cyclically to the CPU. An open input is interpreted as static 0 (LOW).

Pulse recognition and interference suppression

Inputs are read cyclically. Pulses < 100 µs are hardware suppressed. The sampling interval can be parameterised by software. The shortest possible sampling interval is 250 µs.

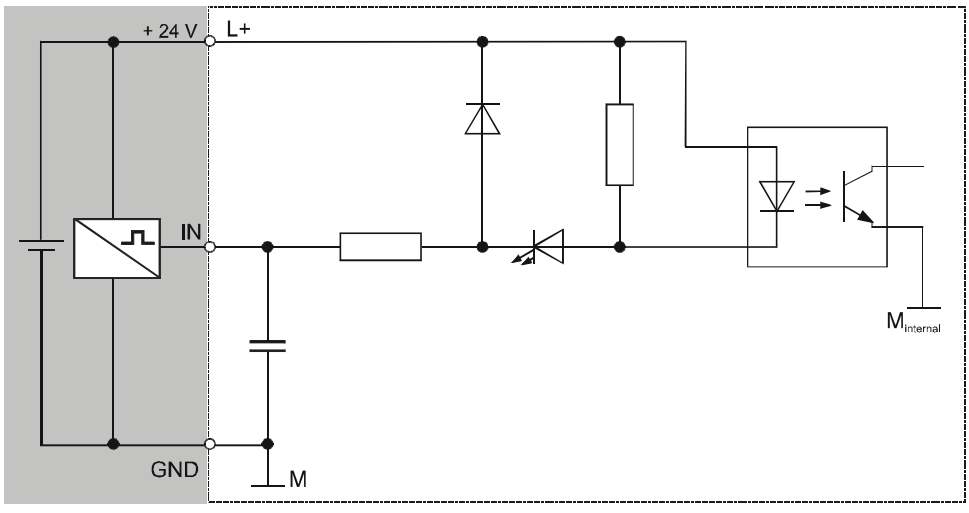
If pulses are to be detected reliably they must be longer than the sampling interval stipulated by software.
Multiple sampling can be programmed in order to suppress spurious pulses.
Sampling interval and multiple sampling (filtering) can be activated in groups of 32 inputs each.

Note:
This function is available only for C applications at present. Using IEC 61131-3 the filter is permanently set to 250 µs.

Operating status

The status of each input is indicated by a yellow operating status LED on the front panel of the module. The LEDs are spatially assigned to the supply terminals.
An LED lights when its associated input is activated (logical 0 / LOW).

4.3.1. Block diagram of input, low side switching



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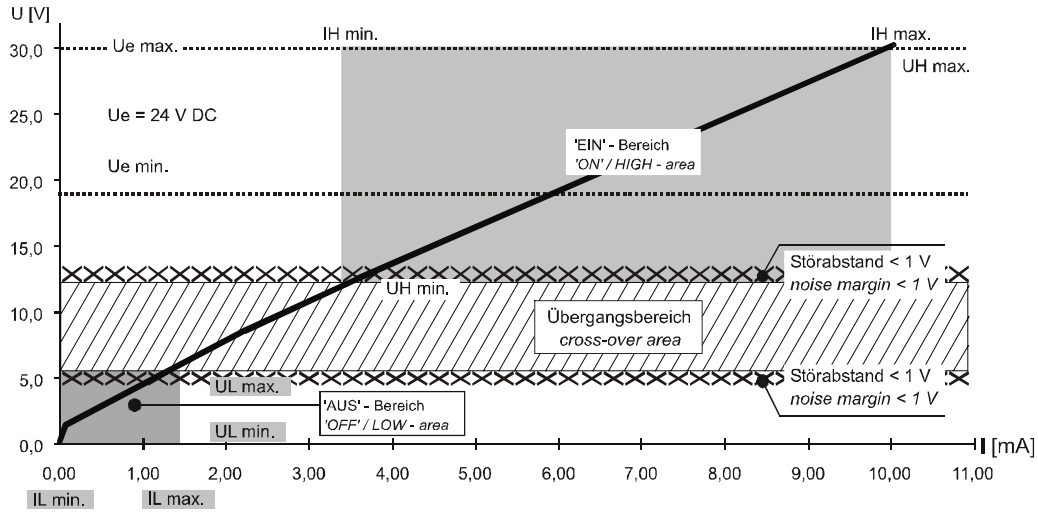
4.3.2. Digital Inputs Data (high side-/low side switching)

Module data	
Number of inputs	16 (max. 32)
Line lengths: in switchgear cabinet dedicated l.v. wiring	 Allow for voltage drop when choosing conductor cross-section, otherwise no restrictions in practice. Observe all relevant local regulations and the requirements of EN 61131-3. Please consult manufacturer regarding lightning hazard
Rated load voltage L+ Reverse voltage protection	24 VDC (SELV) yes
Electrical isolation	yes (optical isolator) in groups
Status display	yes, yellow LED for each input
Alarms	definable according to software
Input delay	parameterisable by software
Input capacitance	< 10 nF

Digital-input operating areas (high side-/low side switching)



Eingangsspannung (DC) der externen Stromversorgung
Input voltage (DC) of extern power supply

Ue	24 V	Bemessungsspannung / *rated voltage*
Ue max.	30 V	oberer Grenzwert / upper *limit*
Ue min.	19,2 V	unterer Grenzwert / *lower limit*

Grenzwerte für '1' Signal für die 'EIN'-Bedingung
Limit for '1' signal for the 'ON'-condition

$UH_{max.}$	30,0 V	obere Spannungsgrenze / upper *voltage limit*
$IH_{max.}$	10,0 mA	obere Stromgrenze / upper *current limit*
$UH_{min.}$	13,5 V	untere Spannungsgrenze / *lower voltage limit*
$IH_{min.}$	3,5 mA	untere Stromgrenze / *lower current limit*

Grenzwerte für '0' Signal für die 'AUS'-Bedingung
Limit for '0' signal of the 'OUT'-condition

$UL_{max.}$	5,5 V	obere Spannungsgrenze / upper *voltage limit*
$IL_{max.}$	1,5 mA	obere Stromgrenze / upper *current limit*
$UL_{min.}$	0 V	untere Spannungsgrenze / *lower voltage limit*
$IL_{min.}$	0 mA	untere Stromgrenze / *lower current limit*

2VF100010DG00.cdr

4.4. Digital Outputs, high side switching

Warning !	The module can be destroyed by overvoltages > 32 V and / or feedback. Risk of **fire!**

Each digital output is also usable as an input. See description under ‘Digital Inputs’ if using as input.

Outputs

The outputs are of high side switching 24 volt type (two-conductor). Maximum output current per output is 500 mA. The outputs have a common earth (GND) when operating in groups. Power is supplied separately from the supply for the modular electronic circuit (see ‘Connection Assignment’).
The outputs switch automatically to ‘0’ (LOW) if there is no available data link to the CPU or if the module’s internal supply is insufficient.

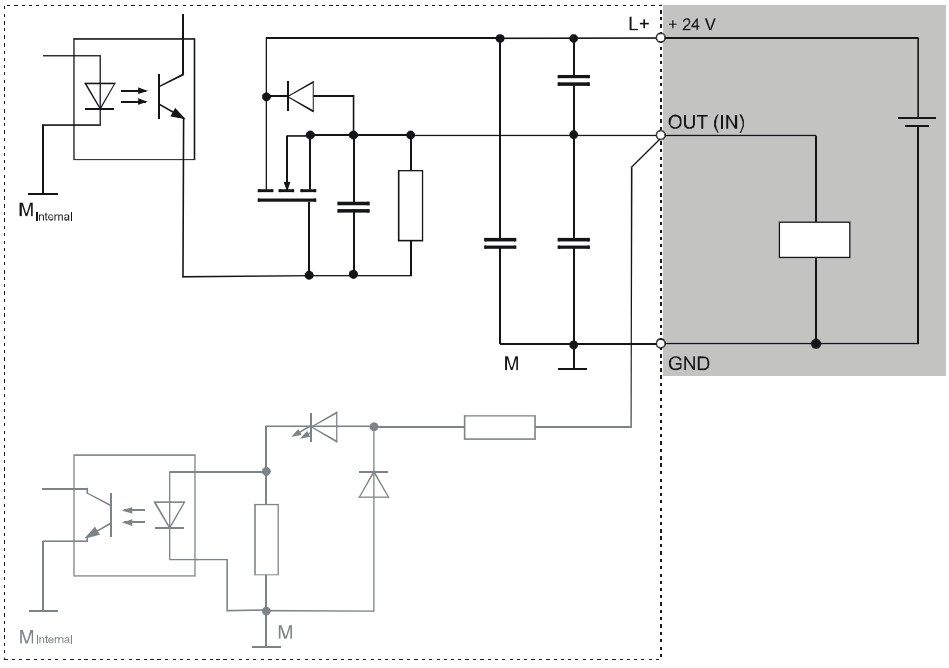
Protected output

All outputs are protected by an incorporated current-limiting circuit and a thermal overload protection circuit. If overloaded, the affected output switches off.
The output can be re-activated by program on elimination of the overload and thermal cooling. A high-speed de-excitation feature having a terminal voltage of 50 V, related to L+, protects all outputs against induced voltage peaks under inductive loads.
The overload protection of non-involved outputs may also respond prematurely if feedback or high-speed de-excitation give rise to thermal loads.

Operating status

The status of each output is indicated by a yellow operating status LED on the front panel of the module. The LEDs are spatially assigned to the supply terminals. A LED lights when its associated output is activated, logical ‘1’ (HIGH).

4.4.1. Block diagram of output high side switching



2VF100011DG01.cdr

4.5. Digital Outputs, low side switching

Warning !	The module can be destroyed by overvoltages > 32 V and / or feedback. Risk of **fire!**

Each digital output is also usable as an input. See description under ‘Digital Inputs’ if using as input.

Outputs

The outputs are of low side switching 24 volt type (two-conductor). Maximum output current per output is 500 mA. The outputs have a common earth (GND) when operating in groups. Power is supplied separately from the supply for the modular electronic circuit (see ‘Connection Assignment’).
The outputs switch automatically to ‘1’ (HIGH) if there is no available data link to the CPU or if the module’s internal supply is insufficient.

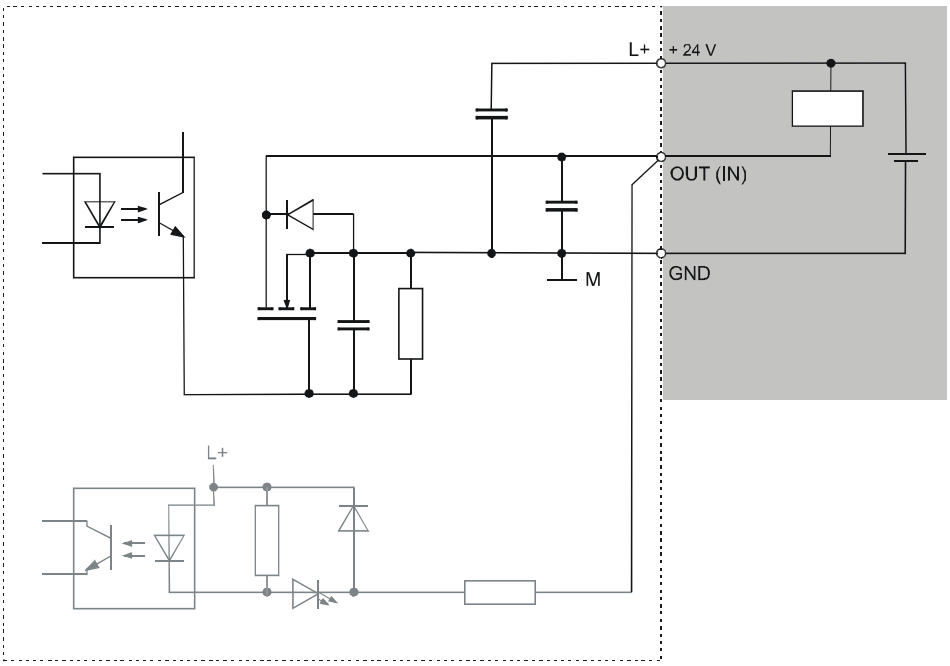
Protected output

All outputs are protected by an incorporated current-limiting circuit and a thermal overload protection circuit. If overloaded, the affected output switches off.
The output can be re-activated by program on elimination of the overload and thermal cooling.
The overload protection of non-involved outputs may also respond prematurely if feedback give rise to thermal loads.

Operating status

The status of each output is indicated by a yellow operating status LED on the front panel of the module. The LEDs are spatially assigned to the supply terminals. A LED lights when its associated output is activated, logical ‘0’ (LOW).

4.5.1. Block diagram of output low side switching



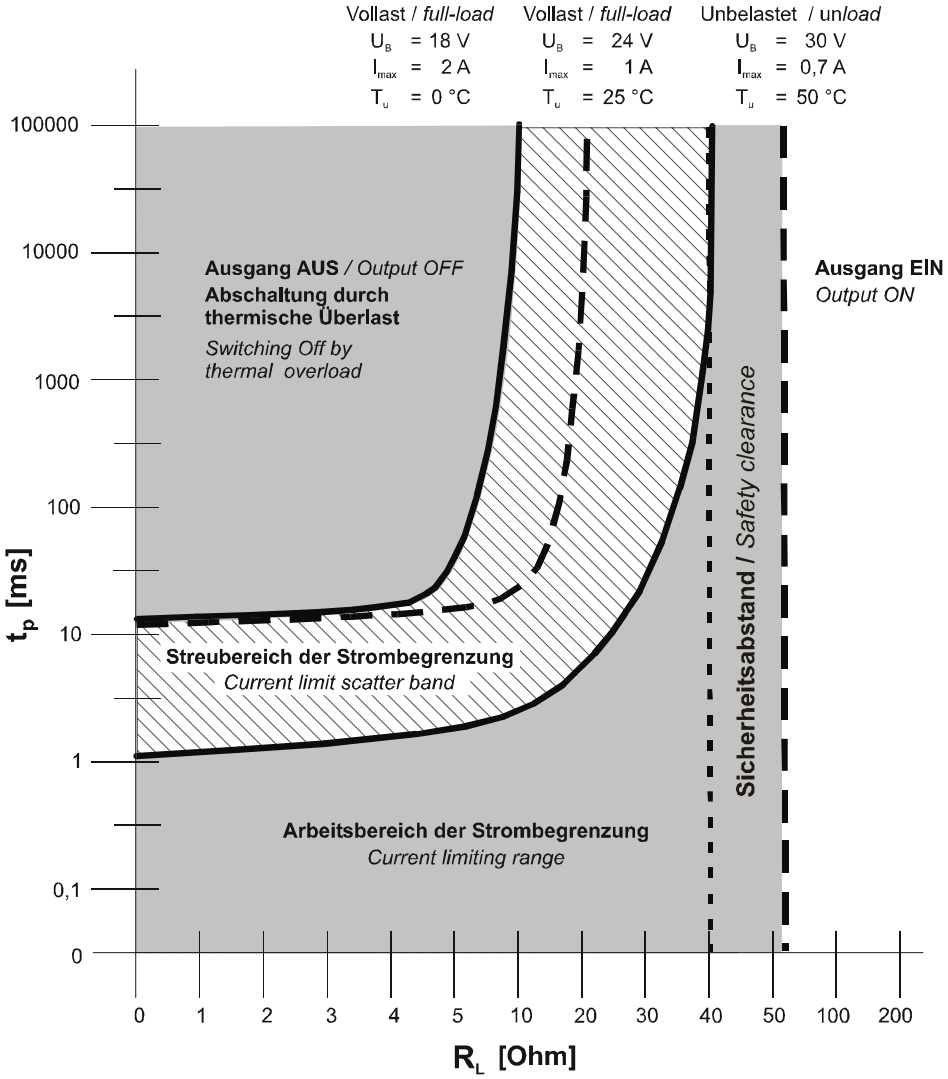
2VF100086DG00.cdr

4.5.2. Digital Outputs Data (high side-/low side switching)

Module data	
Number of outputs	16 semiconductor outputs in 4 groups
Type of outputs	semiconductor, non-holding
Suppressor circuit for inductive loads	high-speed de-excitation 50 V terminal voltage (typical) to + 24 V
Power loss due to de-excitation	max. 0.5 watts per output max. 4 watts per module
Status display	yes, yellow LED for each output
Diagnostic function	yes, switching state can be read back at pin
Load connection	
Total loading (100%)	8 A (16 x 0,5 A)
Overload protection	yes, in event of thermal overload Responding of thermal overload protection may influence adjoining outputs
Short-circuit protection [1)] response threshold	yes, electronic current-limiting feature, min. 0.5 A, typically 0.9 A
1) Current is limited electronically. Responding of the short-circuit protection feature produces thermal overload and trips the thermal overload protection circuit..	
Output delay for ‘0’ to ‘1’ for ‘1’ to ‘0’	 max. 0,5 ms max. 0,5 ms
Output capacitance	< 20 nF
Rated voltage	+24 VDC
Voltage drop (at rated current)	< 0,5 V
Rated current for ‘1’ signal	 0,5 A
Leakage current for ‘0’ signal	 max. 0,1 mA
Total current of all outputs	max. 8 A (16 x 0,5)
Total current per group (horizontal mounting on vertical mounting plate)	max. 2 A (4 x 0,5)
Lamp load (+24 VDC)	max. 6 watts
Connection of two outputs in parallel to provide logic operation to increase performance	 allowed not allowed
Insulation resistance	
Rated voltage	0 V <Ue <50 V
Test voltage up to 2,000 m altitude	500 VDC

Overload Reaction of Digital Outputs (high side-/low side switching)

Überlast-Verhalten der digitalen Ausgänge
Overload-reaction of digital output



Innerhalb des Streubereichs der Strombegrenzung ist das Verhalten der Strombegrenzung undefiniert.
Within the current-limit scatter band the reaction of current limiting is undefined.

2VF100021DG00.cdr

Note:
It is not possible to know for certain within the current limit scatter band whether the response will be to disconnect or to return to the working range. As a result, this state should be avoided!
The output is ready for operation by elimination of the overload and thermal cooling.

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5. Object Dictionaries for Remote I/O Module 16/16

5.1. General

The remote module is a CANopen slave device with a device profile for I/O modules in accordance with Draft Standard (DS) 401 of the CAN users' organisation 'CAN in Automation' (CiA). Up to 224 digital I/Os can be recorded with the remote module. All device profile and communication profile parameters (DS301) are filed in an object dictionary. The communication profile's basic utilities comprise the following:

NMT

The NMT functionality includes node guarding and a minimum boot-up.

Node Guarding

A CANopen master in the CAN network can actuate the remote module using node guarding telegrams. The remote module responds in compliance with the node guarding protocol specification by transmitting the operating condition with a toggle bit. The extended node guarding function (life time monitoring of the master) has been implemented. You can also configure the reaction to a missing guarding telegram.

Boot Up

Once the supply voltage has been switched on, the remote module executes a boot-up process in accordance with CiA DS301 Minimum Capability Device. The change in state from 'Initialising' to 'Preoperational' is displayed using an emergency telegram with no data content. The CAN identifier of the telegram (CobId) is calculated by adding 128 to the node number (NodeId). The remote module then switches to the preoperational state and can be operated using CANopen SDO accesses.
The I/O status LEDs of the digital outputs are not illuminated during boot-up. The outputs are set to 0 (low) when switching the module electronics on and off. They remain in this state until the next switching command. No short switching peaks occur as a result.

I/O Access

All digital I/O channels can be actuated using either SDO or PDO telegrams. All changes to inputs/outputs can generate edge-triggered event PDOs. This is dependent on the status and configuration of the module.

SDO Telegrams

Full access to the object dictionary entries via an SDO channel. When accessing the object dictionary by SDO, the individual objects are selected using an index and subordinate sub-index. The index is displayed as a 16-bit value and the sub-index as an 8-bit value.

PDO Telegrams

To operate the remote module using a PDO (process data object), this must be switched to its operational state using the relevant NMT command (start node). The remote module supports 2 transmit and 2 receive event PDOs.
One transmit and one receive PDO are active without any further configuration once the remote module is 'operational'. It can be deactivated at runtime using corresponding SDO accesses. It relates to the first transmit/receive PDO described in DS401 and so only supports 64 digital I/Os.
For all 224 digital I/Os to be actuated by PDO, there is also one manufacturer-specific transmit PDO and one receive PDO.

Note:
Note that all data are transmitted in Intel 'Little Endian' format but are processed and displayed within the module in Motorola format.

5.2. Access to I/O Data

A remote module comprises 16 digital inputs and 16 digital combined input-output ports (see diagram). It can be expanded with up to six digital I/O expansion modules with the same I/O arrangement. The I/Os are always accessed via the object dictionary. There the I/Os are subdivided into 8-, 16- or 32-bit-wide I/O groups. Beginning with 1, the individual I/O groups are numbered consecutively from left to right in accordance with the physical position of the module.
After the remote is switched on, the system automatically determines the number of I/O modules and the I/O group objects are created correspondingly in the object dictionary. There are 4 objects for the 8-bit group (index 0×6000), 2 objects for the 16-bit group (index 0×6100) and 1 object for the 32-bit group (index 0×6120) per I/O module. The 32-bit object corresponds to the number of I/O modules. The user can read out the values with SDO telegrams. The subindex 0 contains the number of objects that are available in the corresponding group.

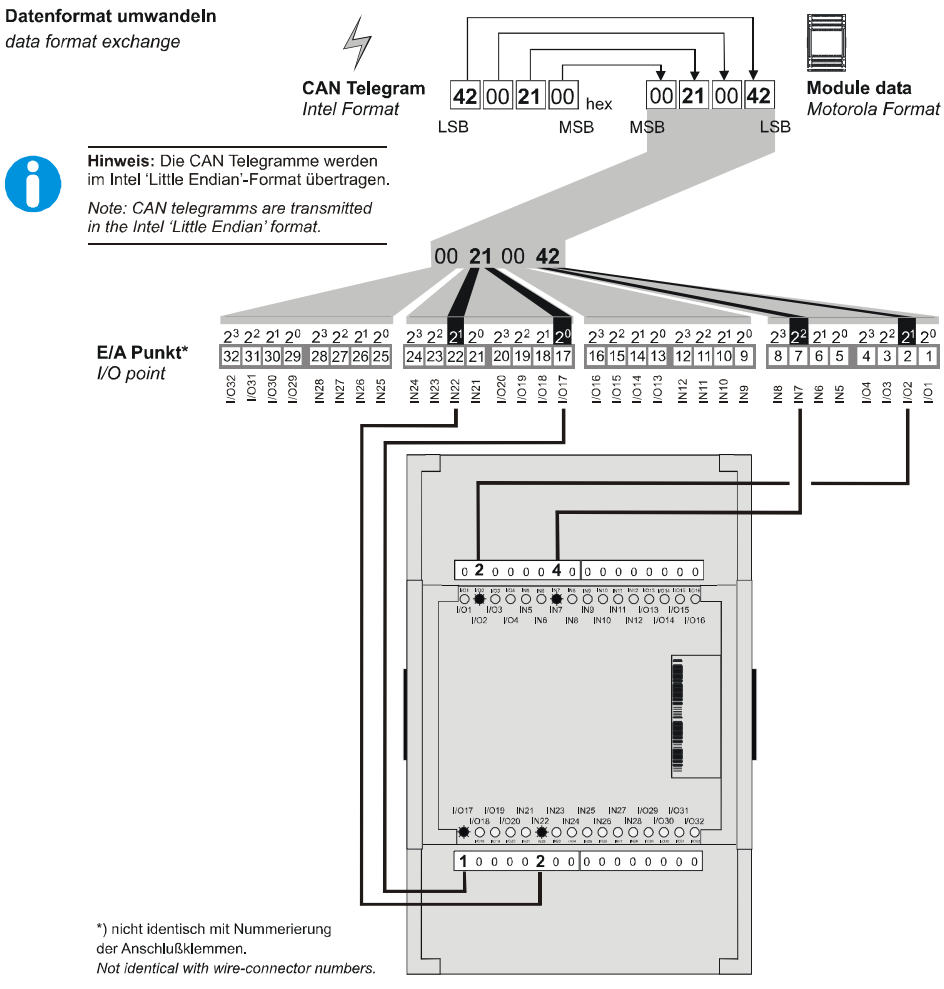
Read accesses

Read accesses provide the current connector status, regardless of whether they are used as an input or output.

Write accesses

With write accesses the respective input bits are masked by the system.

DWORD Datenzugriff auf RDIO E/A Daten
DWORD Data access to RDIO I/O


Datenformat umwandeln
data format exchange
CAN Telegram
Intel Format
42 00 21 00 hex 00 21 00 42
LSB MSB MSB LSB
Module data
Motorola Format
Hinweis: Die CAN Telegramme werden im Intel 'Little Endian'-Format übertragen.
Note: CAN telegramms are transmitted in the Intel 'Little Endian' format.
00 21 00 42
E/A Punkt*
I/O point
*) nicht identisch mit Nummerierung der Anschlußklemmen.
Not identical with wire-connector numbers.

2VF100022DG02.cdr

5.2.1. Operating Status Display (Software)

Operating Status

Five operating status LEDs display the current state of the power supply, module mode and error messages. The general states and their meanings were described in the chapter entitled 'Function Selection, Displays, Diagnosis'. The following outline relates exclusively to special system-dependent software states that are indicated by the operating status LEDs.
Pressing the S key opens a time window for accessing the boot loader/ configuration status. Pressing the S key once while the application module is active illuminates LED4 + LED5. If you press the S key again while these LEDs are illuminated, the boot loader/configuration status is activated. If you do not press the S key a second time - while these LEDs are illuminated - the application module is reset only.
To start the application module from the boot loader, press the S key once only.

CANopen Status

The following outline relates exclusively to special software states of the CANopen software that are indicated by the operating status LEDs.

LED 3	**Meaning**
Blinking	PREOPERATIONAL state
ON	OPERATIONAL state
OFF	Error state (BUS OFF) or boot loader indicated with LED4 or LED5

LED 4	**Meaning**
Blinking	Life Guarding Event
ON	BUS OFF on CAN bus
OFF	Not an error state if LED5 is also off

LED 5	**Meaning**
ON	Life Guarding Event on internal module bus (E-bus)
OFF	Not an error state if LED4 is also off

Diagnostics Monitor

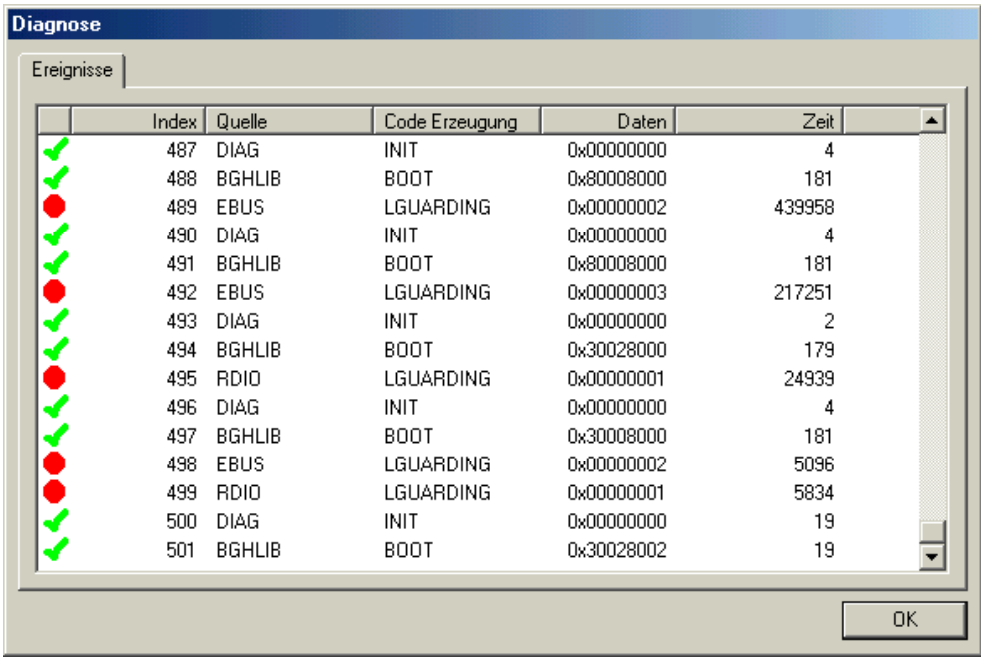
The system software of the module logs system events internally. These are entered in the diagnostics monitor. You can access this data using the software tool CNW. The module-specific features are described here; the online help for CNW contains details of the tool.
The image below shows the diagnostics entries. Logged errors are indicated by a red dot. Two module-specific error states are displayed.

E-bus (internal system bus) Guarding Error:

Source	Code Generation	Data
EBUS	LGUARDING	Manufacturer Specific Status Register

Life Guard Error

Source	Code Generation	Data
RDIO	LGUARDING	Error Register



2VF100105DG00.bmp

5.3. Service Data Objects (SDOs)

All object dictionary entries can be accessed via SDO telegrams. Only the so-called expedited protocol is supported, which can contain up to 4 bytes of user data. In association with this, all object dictionary entries are 4 bytes or less.

The expedited protocol contains a request telegram, transmitted by a CANopen master, and a corresponding response telegram of the CANopen slave modules. Remote modules cannot initiate request telegrams, but merely respond to requests. The Remote module supports one SDO channel. The request and response telegram CAN identifiers (CobId) are derived from the node numbers (NodeId) set by the CNW software. For this purpose, the standard identifiers as stipulated by the CiA DS301 CANopen communication profile are used.

Identifier request telegram (Master -> Slave): 1536 + NodeId

Identifier response telegram (Slave -> Master): 1408 + NodeId

The graphic below is a schematic representation of the expedited protocol structure:
The first byte in the expedited protocol (CMD) contains coding which describes whether data from the slave module object dictionary should be uploaded or downloaded. Index and subindex identify the object. In ‘download data’ the user data of up to 4 bytes are contained in the request telegram, whereas the user data are included in the response telegram in ‘upload data’.

Example 'Download': **Download data to remote module**

	0	1	2	3	4	5	6	7
Request	CMD	Index		Sub-index	Data			
	0	1	2	3	4	5	6	7
Response	CMD	Index		Sub-index	reserved			

Example 'Upload': **Upload data from remote module**

	0	1	2	3	4	5	6	7
Request	CMD	Index		Sub-index	reserved			
	0	1	2	3	4	5	6	7
Response	CMD	Index		Sub-index	Data			

Note:
Please refer to the section on telegram formats for a detailed description of SDO telegrams.

5.4. Process Data Objects (PDOs)

Process data objects (PDOs) are defined as individual, unconfirmed CAN telegrams. They can be transmitted by all users in the network. A PDO therefore always has a transmitter and can be processed by one or several slaves.
The CiA DS301 communication profile defines various object dictionary entries that describe the PDO communication behaviour and the data format. All PDOs supported by the remote module are exclusively defined as asynchronous event PDOs and are not suitable for synchronous operation. The data format of individual PDOs is preset and unchangeable. In the remote module initial state, the first transmit and receive PDO pair is activated. In order that the remote transmits its event PDO, an event interrupt mask has to be activated. The I/O events which lead to a PDO being transmitted are encoded into corresponding bits there. When the remote module is started up, the *'Any Change'* mask appears by default so that a PDO can be transmitted with every edge change at an I/O. When using event interrupt masks it must be ensured that the individual interrupt masks are found in a logical OR relationship to each other. This means that any mask set for rising edges will not be influenced by deletion of the *'Any Change'* mask.

Data formats

The remote module caters for two different data formats:

PDO 1

The first transmit and receive PDO pair (PDO 1) is defined analogously to the CiA DS401 device profile. Thus, up to 64 digital I/Os can be actuated via a single PDO. In connection with the remote module, the I/Os can therefore be operated up to and including the first expansion module. In the initial state of the remote module this PDO pair is activated. The telegram identifiers used are derived from the module node number in accordance with CiA DS301.

Receive PDO 1 : 512 + node number
Transmit PDO 1 : 384 + node number

A second transmit and receive PDO pair (PDO 2) enables all expansion modules to be operated via PDOs up to maximum expansion. These additionally implemented PDOs in the RDIO module use identifiers from the free range between 896 and 1408 as a default setting and are likewise set with respect to the node number. The data format describes the required I/Os by giving the corresponding 32-bit group. In the initial state of the remote module, these additional PDOs are deactivated.

Receive PDO 2 : 1024 + node number
Transmit PDO 2 : 896 + node number

Note:
The second PDO pair, predefined in accordance with CiA DS301, is not supported by the remote module, since this is reserved in the DS401 device profile for analog I/Os.

Identifiers

The predefined identifiers can be changed with respect to operational time using SDO accesses to the object dictionary entries 0×1400, 0×1402 and 0×1800, 0×1802.

Operational state

In order to operate the remote module using PDOs, it must be switched over to operational state with the NMT command 'START NODE'. Then outputs can be switched by PDO and correspondingly programmed edge events will be signalled by the RDIO module via PDO telegrams. In initial state, edge events are active for rising and falling edges at all inputs.

5.5. Emergency Objects

If an error situation occurs on the CANopen slave, this is documented in the error register or manufacturer status register. An emergency telegram is issued for every change made to these registers.

Identifier

The emergency object is sent from the CANopen slave with the identifier = 128 + NodeId.

Format

Byte	0	1	2	3	4	5	6	7
Data	Error Code		Error Register	Manufacturer Status Register				Reserved

Error Codes

0x5001: E-bus (internal system bus) Guarding Error
0x8130: Life Guard Error

5.6. Error Behaviour

Life Guarding

See the section entitled NMT Network Management.

E-bus Guarding

The emergency telegram is issued.
An entry is made in the diagnostics monitor with the content of the manufacturer status register.
LED 5 is illuminated continuously until the module is restarted (reset node).
The module remains operational.

CAN BUS OFF

The digital outputs behave as in a life-guarding case.
An entry is made in the diagnostics monitor (with the value 0).

- LED 4 is illuminated continuously
- LED 3 goes out

A fatal error has occurred. The remote module must be restarted.

5.7. NMT Network Management

Node Guarding

The node guarding function is provided from the CANopen master. A monitoring telegram is issued there in configurable time intervals. The addressed CANopen slave must issue a reply telegram with its current state in response to this. If the reply is not received, the CANopen Master can assume that the slave is no longer operational and react accordingly.

Life Guarding

If a life guarding function has also been activated on the CANopen slave, it can also react to missing node guarding telegrams. This means that if the CANopen master fails, the module can set its outputs to a secure state. The standard setting deactivates outputs. You can change this using corresponding objects.

Life Time

The life time is the period within which a node guarding telegram must be received. If this does not occur, the module proceeds according to the method described above.
The life time is calculated by multiplying the guard time objects (0x100C) by the life time factor (0x100D).

E.g. Guard Time 1000 ms x Life Time Factor 3 = Life Time 3000 ms

Life guarding is only enabled if both values are not equal to 0. However, it is only actually activated if the first node guarding telegram is received. If either of these two objects is set to zero during operation, life guarding is deactivated again.

Note:
The life time can never be shorter than the node guard time of the corresponding master.
The guard time must be at least 10. In addition, only values divisible by 10 without a remainder are permitted. If this is not the case, the system rounds the figure up to the next-highest number divisible by 10.

Life Guarding Event

The life guarding event occurs if the life time is not reached.
The following actions are executed on the module:

1. The module switches to PREOPERATIONAL mode.
2. The digital outputs are set to a defined status, and can be configured using the Fault Mode (0x6306 / 0x6326) and Fault State (0x6307 / 0x6327) objects.
3. An emergency telegram is issued by the remote module. Error code: 0x8130.
4. The life guarding event is noted with the contents of the error register in the module's internal diagnostics monitor.
5. LED4 blinks and indicates the life guarding event.

Restart

If a life guarding event has occurred, the system remains in this state until the next node guarding telegram is received.
A life guarding event can then be triggered again if life guarding remains active.

Life Guarding Objects

0x100C	Guard time in milliseconds	
0x100D	Life time factor	
0x6306	Fault mode, 16-bit	Outputs whose value is modified in the event of an error
0x6307	Fault state, 16-bit	Status assumed by outputs in the event of an error
0x6326	Fault mode, 32-bit	Outputs whose value is modified in the event of an error
0x6327	Fault state, 32-bit	Status assumed by outputs in the event of an error

5.8. DS301 Object Dictionary

This section describes all objects that are supported by the remote module and that are defined in the CiA DS301 communication profile.

In addition, a manufacturer-specific data type for the remote module is defined, which allows more than 64 I/Os to be operated via a PDO.

5.8.1. Overview of Object Dictionary

Index	Object	Name	Type	Acc.
0x1000	VAR	Device type	unsigned32	ro
0x1001	VAR	Error register	unsigned8	ro
0x1002	VAR	Manufacturer Status register	unsigned32	ro
0x1004	ARRAY	Number of PDOs supported	unsigned32	ro
0x1008	VAR	Manufacturer device name	Vis-String	ro
0x1009	VAR	Manufacturer hardware version	Vis-String	ro
0x100C	VAR	Guard Time	unsigned16	rw
0x100D	VAR	Life Time Factor	unsigned8	rw
0x100A	VAR	Manufacturer software version	Vis-String	ro
0x100E	VAR	CobId guarding protocol	unsigned32	rw
0x100F	VAR	Number of SDOs supported	unsigned32	ro
Receive PDO Communication Parameter				
0x1400	RECORD	1st receive PDO parameter	PDOCommPar	rw
0x1402	RECORD	2nd receive PDO parameter	PDOCommPar	rw
Receive PDO Mapping Parameter				
0x1600	RECORD	1st receive PDO mapping	PDOMapping	ro
0x1602	RECORD	2nd receive PDO mapping	PDOMapping	ro
Transmit PDO Communication Parameter				
0x1800	RECORD	1st transmit PDO parameter	PDOCommPar	rw
0x1802	RECORD	2nd transmit PDO parameter	PDOCommPar	rw
Transmit PDO Mapping Parameter				
0x1A00	RECORD	1st transmit PDO mapping	PDOMapping	ro
0x1A02	RECORD	2nd transmit PDO mapping	PDOMapping	ro

5.8.2. Object 0x1002: Manufacturer Specific Status Register

Status Register Layout Byte 0

Bit 0 – 6	A 1 indicates the occurrence of an E-bus life guarding event. The bit position corresponds to the module number.
Bit 7	A life guarding event is indicated here with a 1.
Byte 1-3	Reserved / not yet in use

Note:
This bit information is noted in the module's internal diagnostics monitor in the event of an error. The content of this object is only set to 0 after the module is re-started.

5.8.3. Data Types

Data Types:
Definition

Index (hex)	**Object**	**Name**	**Type**
0x0042	DEFTYPE	Additional Digital PDO Mapping	DigitalPdoMap

Data Types:
DigitalPdoMap

Index (hex)	**Subindex**	**Field in DigitalPdoMap Record**	**Data Type**
0x0042	0	Number of supported entries in the record	Unsigned 8
	1	Digital 32 bit I/O group	Unsigned 8
	2	Data Value	Unsigned 32

Note:
The specification of the 32-bit I/O group is the same as the numbering in DS401 from group 1 to group 7. The entry *Data Value* describes the status of the individual I/Os per group.

Data type:
PdoCommPar
(DS301)

Index (hex)	**Subindex**	**Field in PdoCommPar**	**Data Type**
0x0020	0	Number of supported entries in the record	Unsigned 8
	1	CobId used by PDO	Unsigned 32
	2	Transmission Type	Unsigned 8

Note:
The data type *PdoCommPar* describes the communication parameters of the individual PDOs. During the remote module's operation time, the individual PDOs can be activated or deactivated in this way and the identifiers set can be changed.

The entry *CobId* is identified as follows:

	MSB				LSB
Bits	31	30	29	28 - 11	10 - 0
11-Bit-ID	0/1	0/1	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	11 Bit Identifier
29-Bit-ID	0/1	0/1	1	29 Bit Identifier	

Bit number	Value	Meaning
31 (MSB)	0 1	PDO valid PDO not valid
30	0 1	RTR allowed on this PDO no RTR allowed on this PDO
29	0 1	11-bit ID (CAN 2.0A) 29-bit ID (CAN 2.0B)
28 - 11	0 X	if bit 29 = 0 if bit 29 = 1; bits 28 - 11 of 29 Bit Cob ID
10 - 0 (LSB)	X	Bits 10 - 0 of CobId

Note:
It is not possible to use 29-bit identifiers with the remote module.

Example: **release of the receive PDO 2** (Index 0×1402/subindex 0×01/ID 1026)

	MSB				LSB
11-Bit-ID	0	1	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 0 0 0 0 0 0 0 0 1 0

5.8.4. PDO Mapping

Receive PDO 1 (Default)

Index	Subindex	Comment	Name	Value
0x1600	0	Number of mapped objects		0x08
	1	1st object to be mapped	Write_8_Outputs_1H-8H	0x6200 0x01
	2	2nd object to be mapped	Write_8_Outputs_9H-10H	0x6200 0x02
	3	3rd object to be mapped	Write_8_Outputs_11H-18H	0x6200 0x03
	4	4th object to be mapped	Write_8_Outputs_19H-20H	0x6200 0x04
	5	5th object to be mapped	Write_8_Outputs_21H-28H	0x6200 0x05
	6	6th object to be mapped	Write_8_Outputs_29H-30H	0x6200 0x06
	7	7th object to be mapped	Write_8_Outputs_31H-38H	0x6200 0x07
	8	8th object to be mapped	Write_8_Outputs_39H-40H	0x6200 0x08

Transmit PDO 1 (Default)

Index	Subindex	Comment	Name	Value
0x1A00	0	Number of mapped objects		0x08
	1	1st object to be mapped	Read_8_Inputs_1H-8H	0x6000 0x01
	2	2nd object to be mapped	Read_8_Inputs_9H-10H	0x6000 0x02
	3	3rd object to be mapped	Read_8_Inputs_11H-18H	0x6000 0x03
	4	4th object to be mapped	Read_8_Inputs_19H-20H	0x6000 0x04
	5	5th object to be mapped	Read_8_Inputs_21H-28H	0x6000 0x05
	6	6th object to be mapped	Read_8_Inputs_29H-30H	0x6000 0x06
	7	7th object to be mapped	Read_8_Inputs_31H-38H	0x6000 0x07
	8	8th object to be mapped	Read_8_Inputs_39H-40H	0x6000 0x08

Receive PDO 2 (manufacturer specific)

Index	Subindex	Comment	Name	Value
0x1602	0	Number of mapped objects		0x02
	1	1st object to be mapped	Digital 32 bit I/O group	0x0042 0x01
	2	2nd object to be mapped	Data Value	0x0042 0x02

Transmit PDO 2 (manufacturer specific)

Index	Subindex	Comment	Name	Value
0x1A02	0	Number of mapped objects		0x02
	1	1st object to be mapped	Digital 32 bit I/O group	0x0042 0x01
	2	2nd object to be mapped	Data Value	0x0042 0x02

5.9. DS401 Object Dictionary

This section describes all objects from the *'CiA DS401 device profile for I/O modules'* that are supported by the remote module.

5.9.1. Overview of the Object Dictionary

Digital Input Module

Index	Object	Name	Type	Acc.
0x6000	ARRAY	Read State 8 Input Lines	unsigned 8	ro
0x6005	VAR	Enable Digital Input Interrupt	boolean	rw
0x6006	ARRAY	Input Interrupt Mask 8 Input Lines any change	unsigned 8	rw
0x6007	ARRAY	Input Interrupt Mask 8 Input Lines low to high	unsigned 8	rw
0x6008	ARRAY	Input Interrupt Mask 8 Input Lines high to low	unsigned 8	rw
0x6100	RECORD	Read State 16 Input Lines	unsigned 16	ro
0x6106	RECORD	Input Interrupt Mask 16 Input Lines any change	unsigned 16	rw
0x6107	RECORD	Input Interrupt Mask 16 Input Lines low to high	unsigned 16	rw
0x6108	RECORD	Input Interrupt Mask 16 Input Lines high to low	unsigned 16	rw
0x6120	RECORD	Read State 32 Input Lines	unsigned 32	ro
0x6126	RECORD	Input Interrupt Mask 32 Input Lines any change	unsigned 32	rw
0x6127	RECORD	Input Interrupt Mask 32 Input Lines low to high	unsigned 32	rw
0x6128	RECORD	Input Interrupt Mask 32 Input Lines high to low	unsigned 32	rw

Digital Output Module

Index	Object	Name	Type	Acc.
0x6200	ARRAY	Write State 8 Output Lines	unsigned 8	rw
0x6300	RECORD	Write State 16 Output Lines	unsigned 16	rw
0x6306	RECORD	Fault Mode 16 Output Lines	unsigned 16	rw
0x6307	RECORD	Fault State 16 Output Lines	unsigned 16	rw
0x6320	RECORD	Write State 32 Output Lines	unsigned 32	rw
0x6326	RECORD	Fault Mode 32 Output Lines	unsigned 32	rw
0x6327	RECORD	Fault State 32 Output Lines	unsigned 32	rw

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6. Telegram Formats for Remote I/O Module 16/16

Accessing a remote module in accordance with the CANopen standard can also be done without complete master implementation.

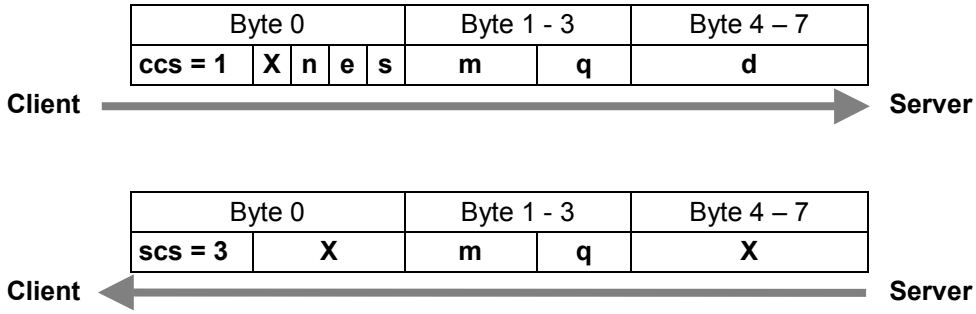
This is done using the SDO protocol, defined as a multiplex domain protocol in the CAL protocol. This is the so-called ‘expedited’ data transfer.

An SDO telegram always consists of a request and a response telegram. The request telegram is transmitted by the client (CANopen master) and the response telegram by the server (CANopen slave).

The user data are identified with the use of a so-called multiplexer. This consists of a 16-bit index entry and an 8-bit subindex entry. Apart from a protocol-specific control byte, a CAN telegram also contains up to 4 bytes worth of space for user data.

Note:
Note that in CAN telegrams all data are transmitted in Intel format (Little Endian) but are processed and displayed within the module in Motorola format.

6.1. Initiate Domain Download Protocol



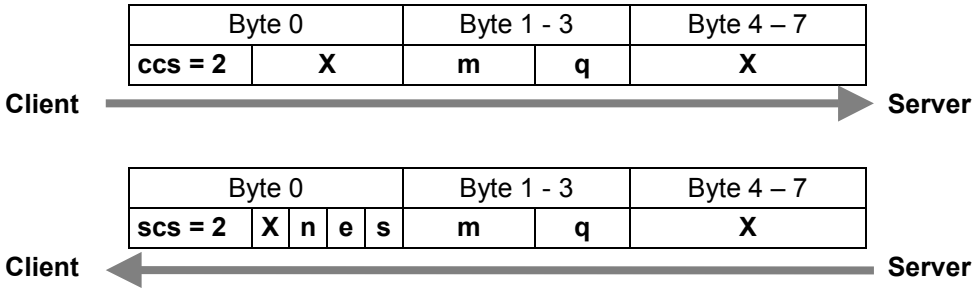
Request telegram Client (CANopen master):

	Short form	Comment
Byte 0		
bit 7-5	**ccs: 001**	client command specifier
bit 4	**X:**	reserved, hence 0
bit 3-2	**n:**	number of bytes not containing valid data, valid if e=1 and s=1
bit 1	**e:**	0: segmented transfer 1: expedited transfer; hence always 1
bit 0	**s:**	0: data size ‘n’ invalid, hence 0 data bytes 1: data size is shown in ‘n’ (normal case)
Byte 1- 2	**m:**	multiplexer (index; 16 bit)
Byte 3	**q:**	multiplexer (subindex; 8 bit)
Byte 4 - 7	**d:**	data

Response telegram Server (CANopen slave):

	Short form	Comment
Byte 0		
bit 7-5	**scs: 011**	server command specifier
bit 4-0	**X:**	reserved, hence 0
Byte 1 - 2	**m:**	multiplexer (index; 16 bit)
Byte 3	**q:**	multiplexer (subindex; 8 bit)
Byte 4 - 7	**X:**	reserved, hence 0

6.2. Initiate Domain Upload Protocol



Request telegram Client (CANopen master):

	Short form	Comment
Byte 0		
bit 7-5	**ccs: 010**	client command specifier
bit 4-0	**X:**	reserved, hence 0
Byte 1 - 2	**m:**	multiplexer (index; 16 bit)
Byte 3	**q:**	multiplexer (subindex; 8 bit)
Byte 4 - 7	**X:**	reserved, hence 0

Response telegram Server (CANopen slave):

	Short form	Comment
Byte 0		
bit 7-5	**scs: 010**	server command specifier
bit 4	**X:**	reserved, hence 0
bit 3-2	**n:**	number of bytes not containing valid data, valid if e=1 and s=1
bit 1	**e:**	0: segmented transfer 1: expedited transfer; hence always 1
bit 0	**s:**	0: data size ‘n’ invalid, hence 0 data bytes 1: data size is shown in ‘n’ (normal case)
Byte 1 - 2	**m:**	multiplexer (index; 16 bit)
Byte 3	**q:**	multiplexer (subindex; 8 bit)
Byte 4 - 7	**d:**	data

6.3. Abort Domain Transfer Protocol

Note:
Both the client and the server can abort a domain transfer at any time with this telegram

Byte 0		Byte 1 - 3		Byte 4 – 7
cs = 4	**X**	**m**	**q**	**d**

Client / Server → **Server/ Client**

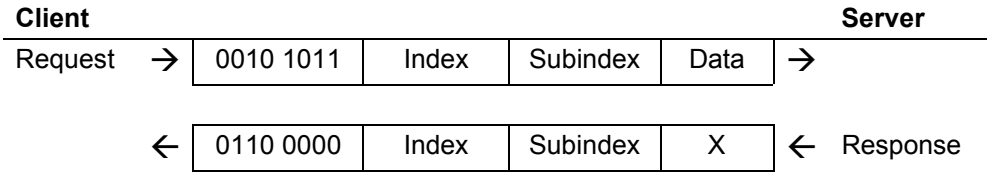
Abort telegram

Client / Server:

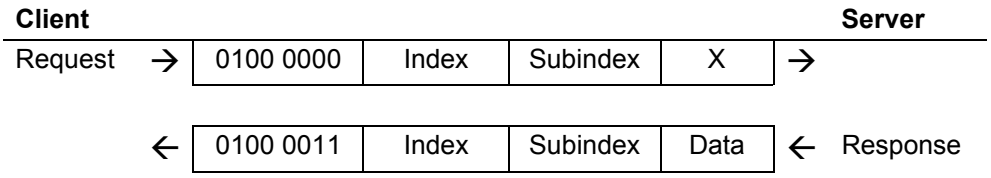
	Short form	Comment
Byte 0		
bit 7-5	**cs: 100**	command specifier
bit 4-0	**X:**	reserved, hence 0
Byte 1 - 2	**m:**	multiplexer (index; 16 bit)
Byte 3	**q:**	multiplexer (subindex; 8 bit)
Byte 4 - 7	**d:**	error code (application-specific)

7. Examples of Telegrams for Remote I/O Module 16/16

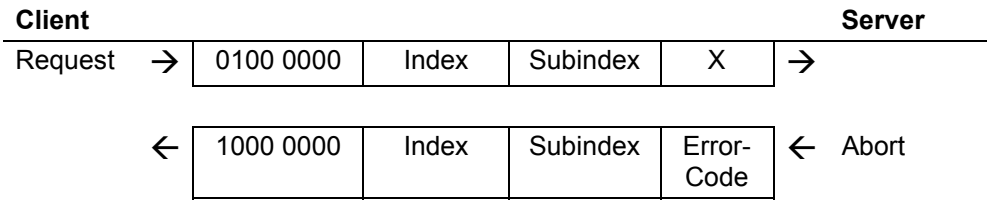
7.1. 16 bit Download



7.2. 32 bit Upload

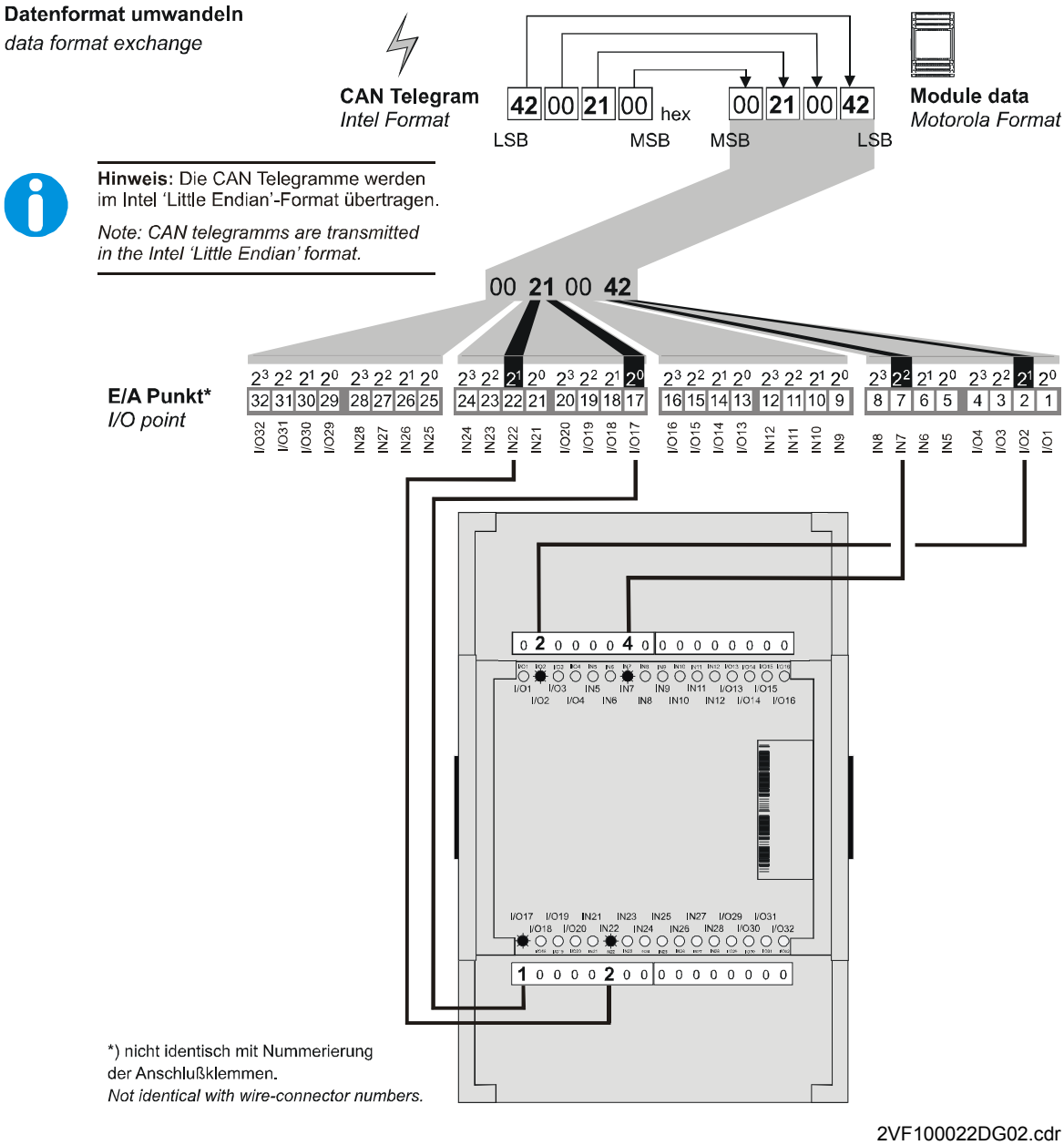


7.3. Upload with abort



7.4. Diagram of Telegram Data

DWORD Datenzugriff auf RDIO E/A Daten
DWORD Data access to RDIO I/O


Datenformat umwandeln
data format exchange
CAN Telegram
Intel Format
42 00 21 00 hex
00 21 00 42
LSB MSB MSB LSB
Module data
Motorola Format
Hinweis: Die CAN Telegramme werden im Intel 'Little Endian'-Format übertragen.
Note: CAN telegramms are transmitted in the Intel 'Little Endian' format.
00 21 00 42
E/A Punkt*
I/O point
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
I/O32 I/O31 I/O30 I/O29 IN28 IN27 IN26 IN25 IN24 IN23 IN22 IN21 I/O20 I/O19 I/O18 I/O17 I/O16 I/O15 I/O14 I/O13 IN12 IN11 IN10 IN9 IN8 IN7 IN6 IN5 I/O4 I/O3 I/O2 I/O1
*) nicht identisch mit Nummerierung der Anschlußklemmen.
Not identical with wire-connector numbers.

2VF100022DG02.cdr

8. Annex

8.1. Environmental Protection

8.1.1. Emission

When used correctly, our modules do not produce any harmful emissions.

8.1.2. Disposal

At the end of their service life, modules may be returned to the manufacturer against payment of an all-inclusive charge to cover costs. The manufacturer will then arrange for the modules to be recycled.

8.2. Maintenance/Upkeep

Warning ! Do not insert, apply, detach or touch connections while in operation – risk of destruction or malfunction.
Disconnect all incoming power supplies before working on our modules; this also applies to connected peripheral equipment such as externally powered sensors, programming devices, etc.
All ventilation openings must always be kept free of any obstruction.

The modules are maintenance-free when used correctly.
Clean only with a dry, non-fluffing cloth.
Do not use detergents.

8.3. Repairs/Service

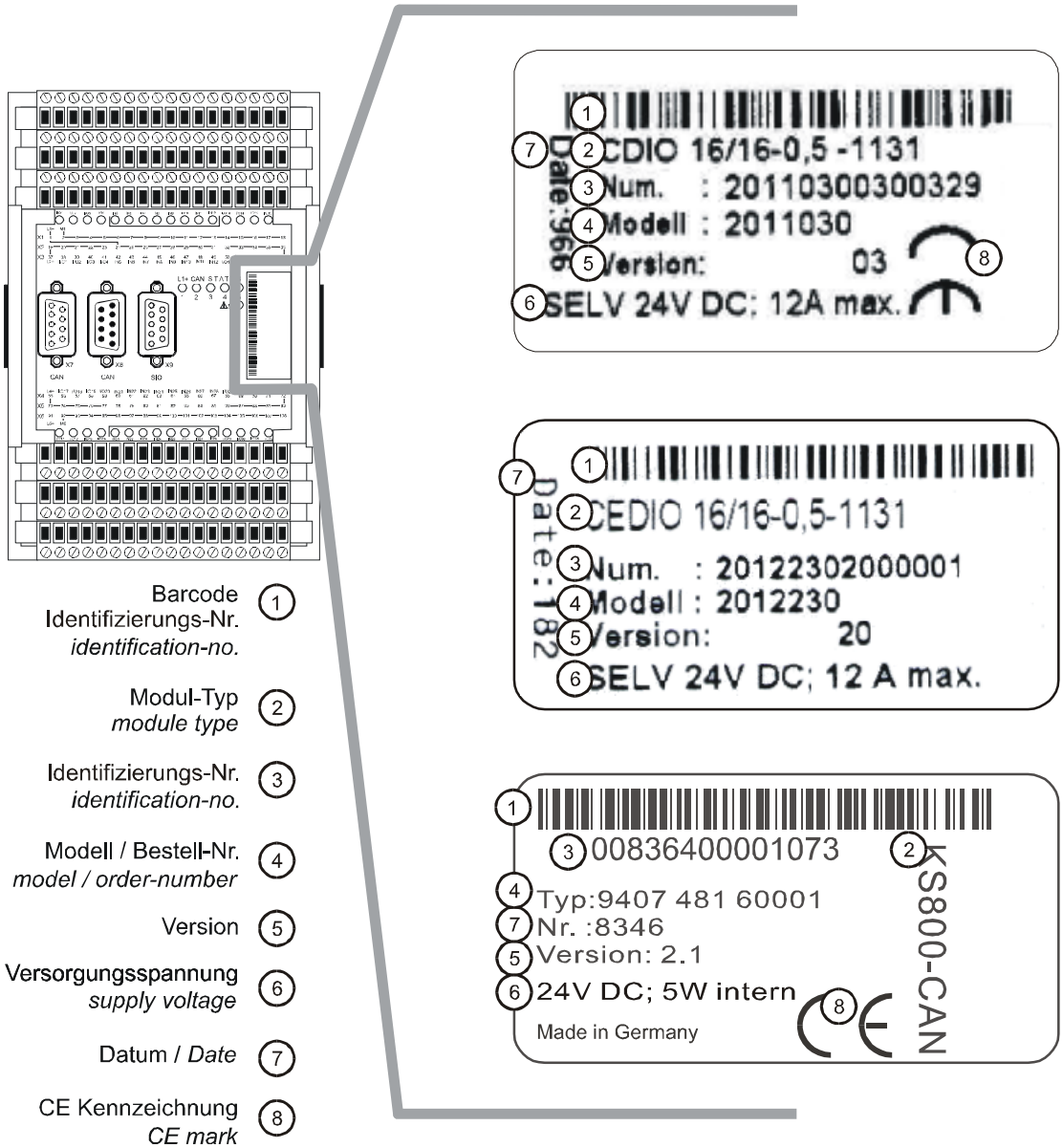
Warning ! Repair work may only be carried out by the manufacturer or its authorised service engineers.

8.3.1. Warranty

Sold under statutory warranty conditions. Warranty lapses in the event of unauthorised attempts to repair the equipment and/or product, or in the event of any other form of intervention.

8.4. Nameplate

Erklärungen zu den Typenschildern (Beispiel)
nameplate descriptions (example)



1 Barcode
Identifizierungs-Nr.
identification-no.

2 Modul-Typ
module type

3 Identifizierungs-Nr.
identification-no.

4 Modell / Bestell-Nr.
model / order-number

5 Version

6 Versorgungsspannung
supply voltage

7 Datum / *Date*

8 CE Kennzeichnung
CE mark

2VF100080DG01.cdr

1 **Barcode**
same as identification number.

2 **Module type**
plain-text name of module.

3 **Identification no.**
module's identification number.

4 **Model/order no.**
You only need to give this number when ordering a module. The module will be supplied in its current hardware and software version.

5 **Version**
defines the design-level of the module as supplied ex-works.

6 **Supply voltage**

7 **Date**
internal code.

8 **CE mark**

Note:
The ‘Version’ (supply version) panel specifies the design-level of the module as supplied ex-works. When replacing a module, users, with the CNW (Cantrol Node Wizard) tool, can read off the current software version of the newly supplied module, and then reload their 'own' software version for a particular project if necessary.
With the latter in mind, before the download you should always keep a record of the existing software levels in your project documentation (software version, node IDs, baud rate, etc.)

8.5. Addresses and Bibliography

8.5.1. Addresses

CiA

'CAN in Automation', international manufacturers and users organisation for CAN users in the field of automation:

CiA - CAN in Automation e.V.
Am Weichselgarten 26
D-91058 Erlangen /Germany
e-mail: headquarters@can-cia.de
http://www.can-cia.de

DIN-EN Standards	Beuth Verlag GmbH 10772 Berlin	or	VDE-Verlag GmbH 10625 Berlin
IEC Standards	VDE Verlag GmbH 10625 Berlin	or	Internet search http://www.iec.ch/

8.5.2. Standards/Bibliography

IEC61131-1/EN61131-1	Programmable controllers Part 1: General information
IEC61131-2/EN61131-2	Programmable controllers Part 2: Equipment requirements and tests
IEC61131-3/EN61131-3	Programmable controllers Part 3: Programming languages
IEC61131-4/EN61131Bl1	Programmable logic controllers Supplementary Sheet 1: User guidelines
EN 50081 Parts 1+2	German EMC Act: Emitted interference
EN 50082 Parts 1+2	German EMC Act: Noise immunity
ISO/DIS 11898	Draft International Standard: Road vehicles - Interchange of digital information - **C**ontroller **A**rea **N**etwork (CAN) for high-speed communication
EN 954-1	Safety of machinery: Safety-related parts of control systems (Part 1)
Bibliography	A variety of specialist publications on the CANbus is available from specialist bookshops, or can be obtained through the CiA users' organisation.

Note:
Our Technical Support team will be glad to provide other literature references on request.